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EXTENSIVE OVERTHRUSTS IN THE BORDER OF THE JESENIKY MTS (MORAVIA, CZECOSLOVAKIA) AND IN THE ARDENNES : A COMPARISON

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In the manuals dealing with structure geology we cannot find an uniform criterion, concerning the differentiation between overthrusts and nappes, based upon the distance of the shifted body. In the Alps and in the Carpathians the nappes are regarded as the indices of the maximum basement mobility accompanied by the development of high pressure and lowe-temperature metamorphosis.

In the Variscan orogene where the high temperature and low pressure metamorphosis (ZWART, 1969) prevails we can encounter extensive block overthrusts there, where the basement mobility was relatively weak.

The Sudeticum in Moravia shows a mirror symmetry with the Rhenohercynicum. Its foreland occurrend in the East in a region where the West Carpathians extend at present. At the SE border of this zone a sea transgression over the gneisses of Proterozoic age followed in the Givetian. During the Givetian and Frasnian the up to 800 m thick reef limestones were laid down there, whereas in the Famennian up to Upper Visêan the condensed sequence of impure limestones was deposited. Only in the uppermost part of the Upper Visêan accelerated subsidence continues again - the up to 1000 m thick formation of shales, siltstones and graywackes accumulates, that pass into the coal-bearing Namurian A filling the foredeep of the Variscan orogene. The sediment complex described has not been folded but in the W border of the foredeep boreholes, that penetrated a depth of several hundreds of meters, reached flat overthrusts of reef limestones over younger sediments in the vicinity of the town Hranice in Moravia (DVOŘÁK *et al.*, 1980).

In 1982, the newly interpreted seismic section K 2 has proved that the above described minor overthrusts accompany an extensive overthrust in the range of about 6 km. In that place the reef limestones of the Devonian were thrust over the horizontally deposited clastic sediments of the Upper Visêan that were penetrated by the Branky - 1 borehole farther towards E. (cfr. fig. 1).

In Moravia the structures plunge axially toward the NNE. Therefore in the NE border of the Jeseníky Mts the reduction of previous sedimentation area is expressed in form of overturned folds of km order produced in response to increased mobility of the basement. The thickness of sediments in the overthrust region is 2-3 km, in the region of great folds 4-5 km.

In the Rhenohercynicum the Rheinische Schiefergebirge (E of Rhine) showed an increased basement mobility with predominant fold structure and cleavage (thick development of clastic sediments) whereas in the Ardennes the limestone development as a result of decreased basement mobility occured since the Middle Devonian. That is why we can encouter extensive overthrusts there (BLESS *et al.*, 1980).

In zones along the overthrusts mentioned, we can observe increased metamorphosis of organic matter due to the ascend of warm waters along tectonically predisposed planes. Therefore it is probable that the overthrust planes situated more closely to the centre of the orogene become steeper and plunge into great depths.

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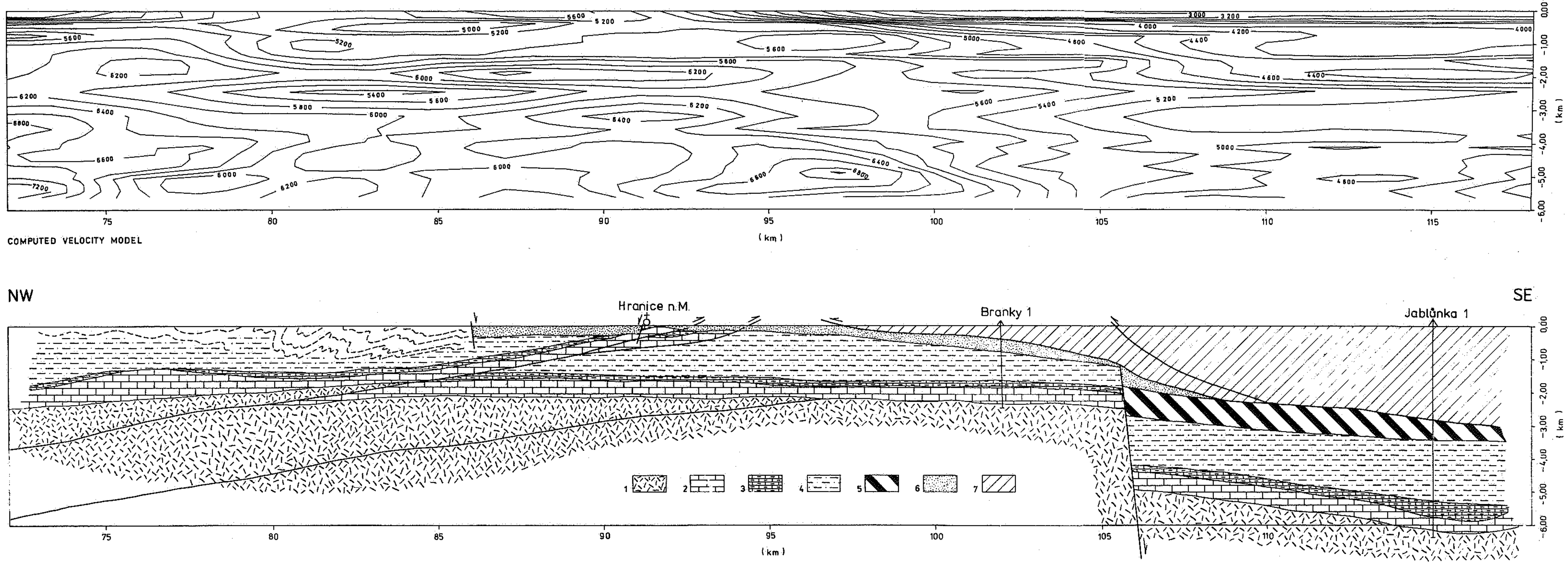

Fig. 1 - Part of the seismic section K2 with geological interpretation showing the situation at the limits between the Variscan orogene (Czech Massif) and the Carpathians.

1. gneiss basement (older Proterozoic),
2. reef-limestones (Givetian-Frasnian),
3. nodulary and organodetrital limestones (Famennian - base of the Upper Visean in East, Upper Frasnian, Lower Viséan in West),
4. Flysch alternation of shales, siltstones and graywackes (Upper Viséan - lowermost Namurian A),
5. coalbearing Carboniferous (Namurian A),
6. Neogene of the Carpathian foredeep,
7. the Carpathian flysch nappes (Jurassic up to Paleogene).

From the genetical point of view, I designate the Variscan structures as overthrusts - not nappes, because they reflect decreased mobility of the Pre-Devonian basement.

COMMENTS ON THE GEOPHYSICS OF THE SEISMIC SECTION K 2 IN FIG. 1 (M. NOVOTNÝ) :

The rather dense set of the shotpoints S = (x_S,0) and registration performed for all epicentral distances q enabled us to use more sophisticated method for interpretation of traveltime curves of refracted waves as a two-dimensional function. In the presence of lateral inhomogeneity in the medium, the velocity inversion of single traveltime curve t(q) usually fails because of the violation of mathematical assumption imposed on t(q) or yields lateral resolution insufficient for interpretation purposes. However, the available two-dimensional time function $t(x_S, x^R)$ with the variable source and receiver coordinates can be transformed into 2D velocity function v(x,z) in a consistent way by the help of the linearizes DIME method suggested recently by (NOVOTNÝ, 1981).

The algorithmus of the grid DIME method consists in searching the unknown velocity values $v(x_j,z_i)$ in a recursive way from the surface z_0 = 0 to deeper and deeper grid levels $z_1 < z_2 < z_3 ... < z_M$. The number of the z-grid lines M is limited by the number of different epicentral distances. Similarly, the density of the x-grid lines is given by the density of the source points S on the profile. Thus, the lateral resolution is determined by the step of the shotpoints. Now, what are the main features of the used DIME method (for details see NOVOTNÝ, 1981).

First, the input arrival times $t(S_i,R_j)$ are rearranged according to the increasing epicentral distances $q_i = X_S - x_R$, i = 1, 2, ..., M to obtain so called special time field t(p,q) - (PUZYREV *et al.* 1972). The other variable p represents here the x-coordinate of the point midway between the source S and receiver R. During the recursive processing, in the j-th step the arrival times t(p,q) for the epincentral distance q = q_j are interpreted taking into account the results of the interpretation from the previous steps.

Secondly, an initial lateral homogeneous velocity model v_0 (z) is defined by inversion of the reference traveltime curve t_{ref} q). The t_{ref} (q_j) function is chosen to minimize the lateral time variancy $\sum [t(p_i,q_j) - t_{ref}(q_j)]^2$ for each epicentral distance q_j.
The initial model $v_0(z)$ is used for generating seismic rays for all involved epicentral distances. The calculated raypaths are necessary for ray interpretation of the lateral time deviations by the linearized version of the eikonal equation (ROMANOV, 1972).

After all steps of recursive ray interpretation the distribution of lateral velocity deviations $\Delta v(x_i,z_j)$ from the initial velocity model $v_0(z_j)$ is obtained. The presented velocity map contains isolines of resulting velocity field $v(x,z) = v_0(z) + \Delta v(x,z)$.
To construct velocity isolines, we fitted the function v(x,z) by splines and resampled into a more dense grid.

As to the reliability of the computed velocity model by the linearized DIME method, the tests with raytracing programs (ČERVENÝ *et al.*, 1977) showed, that time discrepancies detected are smaller than 3 % provided that lateral velocity inhomogeneity is not larger than ± 50 %.

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